WHAT IS CLAIMED IS:

1. A communication network having a plurality of optical communication devices connected with each other, comprising:

uni-directional in-band control channels provided in every optical links leading from the output interfaces of one of adjoining first and second optical communication devices to the input interfaces of the other of the first and second optical communication devices, between the interfaces of the first and second optical communication devices along and for the every optical links; and

an out-band control channel provided between the first and second optical communication devices,

wherein the first and second optical communication devices include: control channel terminators for terminating the uni-directional in-band control channels and the out-band control channel; and optical link controllers for administering the every optical links by exchanging control messages through the control channel terminators.

2 A communication network according to Claim 1, wherein at least one of the first and second optical communication devices is an optical switch equipment which is constructed to use a transparent optical switch.

3. A communication network according to Claim 1, wherein the signal wave band of the data channel on the optical links and the signal wave band of the uni-directional in-band control channel s are different, and wherein the interfaces of the first and second optical communication devices include WDM couplers for demultiplexing/multiplexing the two difference wave bands in all the optical links.

4. A communication network according to Claim 3, wherein in any of optical transmitters and optical receivers for transmitting control messages to the uni-directional in-band control channels, 1 x N (N: a positive integer) optical switches connected with either one optical transmitter or one optical receiver are

switched at a predetermined time interval to time-division share either the optical transmitter or the optical receiver among the N uni-directional control channels.

5. A communication network according to Claim 1, wherein:

the signal wave band of the data channel on the optical links and the signal wave band of the uni-directional in-band control channels are identical,

the interfaces of the first and second optical communication devices include 1 x 2 optical switches provided in all optical links, and

the optical links are employed as data channels during the data transmission and as control channels at other times by switching the 1 x 2 optical switches.

6. A communication network according to Claim 5, wherein in any of optical transmitters and optical receivers for transmitting control messages to the uni-directional in-band control channels, 1 x N (N: a positive integer) optical switches connected with either one optical transmitter or one optical receiver are switched at a predetermined time interval to time-division share either the optical transmitter or the optical receiver among the N uni-directional control channels.

7. A communication network according to Claim 1, wherein the optical link controllers:

administer individual optical link attribute tables for specifying the attribute items of the optical links and their attribute values individually for the every optical links;

discover the attributes of the optical links by storing the individual optical link attribute tables in the control messages and exchanging them mutually, by comparing the attribute values for the every attribute items of the individual optical link attribute tables, and by collecting the common portions of the attribute values;

set up the optical links, of which the discovery of the attributes has failed, in an initial state;

set up the optical links, of which the discovery of the attributes has succeeded, in an usable state; and

set up the optical links, of which no common portion of the attribute values has existed so that the discovery of the attributes has failed, as an error in an unusable state,

thereby to perform the state administrations for the every optical links.

8. A communication network according to Claim 7, wherein the optical link attribute tables to be administered by the optical link controllers include a device No., an interface No., a wavelength, a signal rate and a signal format or physical characteristics of optical fibers constructing the optical links as the attribute items of the optical links.

9. A communication network according to Claim 7, wherein the attributes of the optical links, which have been discovered by collecting the common portions of the attribute items of the optical link attribute tables administered by the optical link controllers, include an output device No., an output interface No., a wavelength, a signal rate, a signal format, an input device No., an input interface No., or physical characteristics of optical fibers constructing the optical links as the attribute items.

10. A communication network having a plurality of optical communication devices connected with each other, comprising:

a first uni-directional in-band control channel provided in every downstream optical links leading from the output interfaces of one of adjoining first and second optical communication devices to the input interfaces of the other of the first and second optical communication devices, between the interfaces of the first and second optical communication devices along and for the every downstream optical links; and

a second uni-directional in-band control channel provided in every upstream optical links leading from the output interfaces of the other of the first and second optical communication devices to the input interfaces of the one of the first and second optical communication devices, between the interfaces of the first and second optical communication devices along and for the every upstream

optical links and directed in the direction opposite to the control channel in the downstream optical links,

wherein the first and second optical communication devices include: control channel terminators for terminating the first and second uni-directional in-band control channels, respectively; and optical link controllers for administering the every optical links by exchanging control messages through the control channel terminators.

11. A communication network according to Claim 10, wherein:

at least one of the first and second optical communication devices is an optical switch equipment which is constructed to use a transparent optical switch.

12. A communication network according to Claim 10, wherein the signal wave band of the data channel on the optical links and the signal wave band of the uni-directional in-band control channel s are different, and

wherein the interfaces of the first and second optical communication devices include WDM couplers for demultiplexing/multiplexing the two difference wave bands in all the optical links.

13. A communication network according to Claim 12, wherein in any of optical transmitters and optical receivers for transmitting control messages to the uni-directional in-band control channels, 1 x N (N: a positive integer) optical switches connected with either one optical transmitter or one optical receiver are switched at a predetermined time interval to time-division share either the optical transmitter or the optical receiver among the N uni-directional control channels.

14. A communication network according to Claim 10, wherein:

the signal wave band of the data channel on the optical links and the signal wave band of the uni-directional in-band control channels are identical,

the interfaces of the first and second optical communication devices include 1 x 2 optical switches provided in all optical links, and

the optical links are employed as data channels during the data transmission and as control channels at other times by switching the 1 x 2 optical switches.

15. A communication network according to Claim 14, wherein in any of optical transmitters and optical receivers for transmitting control messages to the uni-directional in-band control channels, 1 x N (N: a positive integer) optical switches connected with either one optical transmitter or one optical receiver are switched at a predetermined time interval to time-division share either the optical transmitter or the optical receiver among the N uni-directional control channels.

16. A communication network according to Claim 10, wherein the optical link controllers:

administer individual optical link attribute tables for specifying the attribute items of the optical links and their attribute values individually for the every optical links;

discover the attributes of the optical links by storing the individual optical link attribute tables in the control messages and exchanging them mutually, by comparing the attribute values for the every attribute items of the individual optical link attribute tables, and by collecting the common portions of the attribute values;

set up the optical links, of which the discovery of the attributes has failed, in an initial state;

set up the optical links, of which the discovery of the attributes has succeeded, in an usable state; and

set up the optical links, of which no common portion of the attribute values has existed so that the discovery of the attributes has failed, as an error in an unusable state,

thereby to perform the state administrations for the every optical links.

17. A communication network according to Claim 16, wherein the optical link attribute tables to be administered by the optical link controllers include a device No., an interface No., a wavelength, a signal rate and a signal

format or physical characteristics of optical fibers constructing the optical links as the attribute items of the optical links

18. A communication network according to Claim 16, wherein the attributes of the optical links, which have been discovered by collecting the common portions of the attribute items of the optical link attribute tables administered by the optical link controllers, include an output device No., an output interface No., a wavelength, a signal rate, a signal format, an input device No., an input interface No., or physical characteristics of optical fibers constructing the optical links as the attribute items.

19. A communication network having a plurality of optical communication devices connected with each other, comprising:

a bi-directional in-band control channel provided in every optical links, leading from the output interfaces of one of adjoining first and second optical communication devices to the input interfaces of the other of the first and second optical communication devices, between the interfaces of the first and second optical communication devices along and for the every optical links,

wherein the first and second optical communication devices include: a control channel terminator for terminating the bi-directional in-band control channels; and optical link controllers for administering the every optical links by exchanging control messages through the control channel terminators.

20. A communication network according to Claim 19, wherein at least one of the first and second optical communication devices is an optical switch equipment which is constructed to use a transparent optical switch.

21. A communication network according to Claim 19, wherein the optical link controllers:

administer individual optical link attribute tables for specifying the attribute items of the optical links and their attribute values individually for the every optical links;

discover the attributes of the optical links by storing the individual optical link attribute tables in the control messages and exchanging them mutually, by comparing the attribute values for the every attribute items of the individual optical link attribute tables, and by collecting the common portions of the attribute values;

set up the optical links, of which the discovery of the attributes has failed, in an initial state;

set up the optical links, of which the discovery of the attributes has succeeded, in an usable state; and

set up the optical links, of which no common portion of the attribute values has existed so that the discovery of the attributes has failed, as an error in an unusable state,

thereby to perform the state administrations for the every optical links.

22. A communication network according to Claim 21, wherein the optical link attribute tables to be administered by the optical link controllers include a device No., an interface No., a wavelength, a signal rate and a signal format or physical characteristics of optical fibers constructing the optical links as the attribute items of the optical links.

23. A communication network according to Claim 21, wherein the attributes of the optical links, which have been discovered by collecting the common portions of the attribute items of the optical link attribute tables administered by the optical link controllers, include an output device No., an output interface No., a wavelength, a signal rate, a signal format, an input device No., an input interface No., or physical characteristics of optical fibers constructing the optical links as the attribute items.

24. A communication network having a plurality of optical communication devices connected with each other through WDM transmission equipments, comprising:

a first uni-directional in-band control channel provided in every optical links leading from the output interfaces of one of first and second optical

communication devices, which adjoin each other through an optical multiplex section including at least one set of opposed WDM transmission equipments and an arbitrary number of optical amplifiers between the opposed WDM transmission equipments, to the input interfaces of the other of the first and second optical communication devices through the optical multiplex section, between the interfaces of the first and second optical communication devices and the ports of the WDM transmission equipments connected with the interfaces, along and for the every optical links;

a second uni-directional in-band control channel provided in the optical multiplex section between the output ports of one of the opposed WDM transmission equipments and the input ports of the other, along the optical links; and

an out-band control channel provided between the first and second optical communication devices,

wherein the first and second optical communication devices include: control channel terminators for terminating the first uni-directional in-band control channels and the out-band control channel; and optical link controllers for administering the every optical links by exchanging control messages through the control channel terminators, and

wherein the opposed WDM transmission equipments include: control channel terminators for terminating the first and second uni-directional in-band control channels; and optical link controllers for administering the every optical links by exchanging control messages through the control channel terminators.

25. A communication network according to Claim 24, wherein at least one of the first and second optical communication devices is an optical switch equipment which is constructed to use a transparent optical switch.

26. A communication network according to Claim 24, wherein:

the signal wave band of the data channel on the optical links and the signal wave band of the uni-directional in-band control channels are different, and

the interfaces of the first and second optical communication devices and the ports of the opposed WDM transmission equipments include WDM couplers for demultiplexing/multiplexing the two different wave bands in all the optical links.

27. A communication network according to Claim 26 , wherein in any of optical transmitters and optical receivers for transmitting control messages to the uni-directional in-band control channels, 1 x N (N: a positive integer) optical switches connected with either one optical transmitter or one optical receiver are switched at a predetermined time interval to time-division share either the optical transmitter or the optical receiver among the N uni-directional control channels.

28. A communication network according to Claim 24, wherein:

the signal wave band of the data channel on the optical links and the signal wave band of the uni-directional in-band control channels are identical,

the interfaces of the first and second optical communication devices and the ports of the opposed WDM transmission equipments include 1 x 2 optical switches provided in all optical links, and

the optical links are employed as data channels during the data transmission and as control channels at other times by switching the 1 x 2 optical switches.

29. A communication network according to Claim 28, wherein in any of optical transmitters and optical receivers for transmitting control messages to the uni-directional in-band control channels, 1 x N (N: a positive integer) optical switches connected with either one optical transmitter or one optical receiver are switched at a predetermined time interval to time-division share either the optical transmitter or the optical receiver among the N uni-directional control channels.

30. A communication network according to Claim 24

wherein the individual optical link controllers of the first and second optical communication devices and the opposed WDM transmission equipments:

administer individual optical link attribute tables for specifying the attribute items of the optical links and their attribute values individually for the every optical links;

discover the attributes of the optical links by storing the individual optical link attribute tables in the control messages and exchanging them mutually, by comparing the attribute values for the every attribute items of the individual optical link attribute tables, and by collecting the common portions of the attribute values;

set up the optical links, of which the discovery of the attributes has failed, in an initial state;

set up the optical links, of which the discovery of the attributes has succeeded, in an usable state; and

set up the optical links, of which no common portion of the attribute values has existed so that the discovery of the attributes has failed, as an error in an unusable state,

thereby to perform the state administrations for the every optical links.

31. A communication network according to Claim 30, wherein the optical link attribute tables to be administered by the optical link controllers on the first and second optical communication devices include an optical switch equipment No., an interface No., a wavelength, a signal rate, a signal format, a distance between the opposed WDM transmission equipments in the optical multiplex section or physical characteristics of optical fibers constructing the optical links as the attribute items of the optical links.

32. A communication network according to Claim 30, wherein the optical link attribute tables to be administered by the optical link controllers on the WDM transmission equipments include a wavelength, a signal rate, a signal format, an optical multiplex section group No., a distance between the opposed WDM transmission equipments in the optical multiplex section or physical characteristics of optical fibers constructing the optical links as the attribute items of the optical links.

33. A communication network according to Claim 30, wherein the attributes of the optical links, which have been discovered by collecting the common portions of the attribute items of the optical link attribute tables administered by the optical link controllers, include an output optical switch equipment No., an output interface No., a wavelength, a signal rate, a signal format, an optical multiplex section group No., an input optical switch equipment No., a distance between the opposed WDM transmission equipments in the optical multiplex section or physical characteristics of optical fibers constructing the optical links as the attribute items.

34. A communication network having a plurality of optical communication devices connected with each other through WDM transmission equipments, comprising:

a first uni-directional in-band control channel provided in every downstream optical links leading from the output interfaces of one of first and second optical communication devices, which adjoin each other through an optical multiplex section including at least one set of opposed WDM transmission equipments for transmitting downstream and upstream signals individually and an arbitrary number of optical amplifiers between the opposed WDM transmission equipments, to the input interfaces of the other of the first and second optical communication devices through the optical multiplex section, between the interfaces of the first and second optical communication devices and the ports of the WDM transmission equipments connected with the interfaces, along and for the every downstream optical links,

a second uni-directional in-band control channel provided in the optical multiplex section between the output ports of one of the opposed WDM transmission equipments for transmitting the downstream signals and the input ports of the other, along the downstream optical links;

a third uni-directional in-band control channel provided in every upstream optical links leading from the output interfaces of the other optical communication

device of the first and second optical communication devices through the optical multiplex section to the input interfaces of the one optical communication device of the first and second optical communication devices, between the interfaces of the first and second optical communication devices and the ports of the WDM transmission equipment connected with the interfaces, along and for the every upstream downstream optical links and directed in the direction opposite to the control channels in the downstream optical links; and

a fourth uni-directional in-band control channel provided in the optical multiplex section between the output ports of one of the opposed WDM transmission equipments for transmitting the upstream signals and the input ports of the other and directed in the direction opposite to the control channels in the downstream optical links, along the upstream optical links,

wherein the first and second optical communication devices include: control channel terminators for terminating the first and third uni-directional in-band control channels; and optical link controllers for administering the every optical links by exchanging control messages through the control channel terminators,

wherein the opposed WDM transmission equipments for transmitting the downstream signals include: control channel terminators for terminating the first and second uni-directional in-band control channels; and optical link controllers for administering the every optical links by exchanging control messages through the control channel terminators, and

wherein the opposed WDM transmission equipments for transmitting the upstream signals include: control channel terminators for terminating the third and fourth uni-directional in-band control channels; and optical link controllers for administering the every optical links by exchanging control messages through the control channel terminators.

35. A communication network according to Claim 34, wherein at least one of the first and second optical communication devices is an optical switch equipment which is constructed to use a transparent optical switch.

36. A communication network according to Claim 34, wherein:

the signal wave band of the data channel on the optical links and the signal wave band of the uni-directional in-band control channels are different, and

the interfaces of the first and second optical communication devices and the ports of the opposed WDM transmission equipments include WDM couplers for demultiplexing/multiplexing the two different wave bands in all the optical links.

37. A communication network according to Claim 36 , wherein in any of optical transmitters and optical receivers for transmitting control messages to the uni-directional in-band control channels, 1 x N (N: a positive integer) optical switches connected with either one optical transmitter or one optical receiver are switched at a predetermined time interval to time-division share either the optical transmitter or the optical receiver among the N uni-directional control channels.

38. A communication network according to Claim 34, wherein:

the signal wave band of the data channel on the optical links and the signal wave band of the uni-directional in-band control channels are identical,

the interfaces of the first and second optical communication devices and the ports of the opposed WDM transmission equipments include 1 x 2 optical switches provided in all optical links, and

the optical links are employed as data channels during the data transmission and as control channels at other times by switching the 1 x 2 optical switches.

39. A communication network according to Claim 38, wherein in any of optical transmitters and optical receivers for transmitting control messages to the uni-directional in-band control channels, 1 x N (N: a positive integer) optical switches connected with either one optical transmitter or one optical receiver are

switched at a predetermined time interval to time-division share either the optical transmitter or the optical receiver among the N uni-directional control channels.

40. A communication network according to Claim 34,

wherein the individual optical link controllers of the first and second optical communication devices and the opposed WDM transmission equipments:

administer individual optical link attribute tables for specifying the attribute items of the optical links and their attribute values individually for the every optical links;

discover the attributes of the optical links by storing the individual optical link attribute tables in the control messages and exchanging them mutually, by comparing the attribute values for the every attribute items of the individual optical link attribute tables, and by collecting the common portions of the attribute values;

set up the optical links, of which the discovery of the attributes has failed, in an initial state;

set up the optical links, of which the discovery of the attributes has succeeded, in an usable state; and

set up the optical links, of which no common portion of the attribute values has existed so that the discovery of the attributes has failed, as an error in an unusable state,

thereby to perform the state administrations for the every optical links.

41. A communication network according to Claim 40, wherein the optical link attribute tables to be administered by the optical link controllers on the first and second optical communication devices include at least an optical switch equipment No., an interface No., a wavelength, a signal rate, a signal format, a distance between the opposed WDM transmission equipments in the optical multiplex section or physical characteristics of optical fibers constructing the optical links as the attribute items of the optical links.

42. A communication network according to Claim 40, wherein:

the optical link attribute tables to be administered by the optical link controllers on the WDM transmission equipments include at least a wavelength, a signal rate, a signal format and an optical multiplex section group No., a distance between the opposed WDM transmission equipments in the optical multiplex section or physical characteristics of optical fibers constructing the optical links as the attribute items of the optical links.

43. A communication network according to Claim 40, wherein the attributes of the optical links, which have been discovered by collecting the common portions of the attribute items of the optical link attribute tables administered by the optical link controllers, include an output optical switch equipment No., an output interface No., a wavelength, a signal rate, a signal format, an optical multiplex section group No., an input optical switch equipment No., a distance between the opposed WDM transmission equipments in the optical multiplex section or physical characteristics of optical fibers constructing the optical links as the attribute items.

44. A communication network having a plurality of optical communication devices connected with each other through WDM transmission equipments, comprising:

a first bi-directional in-band control channel provided in every optical links leading from the output interfaces of one optical communication device of first and second optical communication devices, which adjoin each other through an optical multiplex section including at least one set of opposed WDM transmission equipments and an arbitrary number of optical amplifiers between the opposed WDM transmission equipments, to the input interfaces of the other optical communication device of the first and second optical communication devices through the optical multiplex section, between the interfaces of the first and second optical communication devices and the ports of the WDM transmission equipments connected with the interfaces, along and for the every optical links; and

a second bi-directional in-band control channel provided in the optical multiplex section between the output ports of one of the opposed WDM transmission equipments and the input ports of the other, along the optical links,

wherein the first and second optical communication devices include: control channel terminators for terminating the first bi-directional in-band control channel; and optical link controllers for administering the every optical links by exchanging control messages through the control channel terminators, and

wherein the opposed WDM transmission equipments include: control channel terminators for terminating the first and second bi-directional in-band control channels; and optical link controllers for administering the every optical links by exchanging control messages through the control channel terminators.

45. A communication network according to Claim 44, wherein at least one of the first and second optical communication devices is an optical switch equipment which is constructed to use a transparent optical switch.

46. A communication network according to Claim 44,

wherein the individual optical link controllers of the first and second optical communication devices and the opposed WDM transmission equipments:

administer individual optical link attribute tables for specifying the attribute items of the optical links and their attribute values individually for the every optical links;

discover the attributes of the optical links by storing the individual optical link attribute tables in the control messages and exchanging them mutually, by comparing the attribute values for the every attribute items of the individual optical link attribute tables, and by collecting the common portions of the attribute values;

set up the optical links, of which the discovery of the attributes has failed, in an initial state;

set up the optical links, of which the discovery of the attributes has succeeded, in an usable state; and

set up the optical links, of which no common portion of the attribute values has existed so that the discovery of the attributes has failed, as an error in an unusable state,

thereby to perform the state administrations for the every optical links.

47. A communication network according to Claim 46, wherein the optical link attribute tables to be administered by the optical link controllers on the first and second optical communication devices include at least an optical switch equipment No., an interface No., a wavelength, a signal rate and a signal format, a distance between the opposed WDM transmission equipments in the optical multiplex section or physical characteristics of optical fibers constructing the optical links as the attribute items of the optical links.

48. A communication network according to Claim 46, wherein the optical link attribute tables to be administered by the optical link controllers on the WDM transmission equipments include at least a wavelength, a signal rate, a signal format and an optical multiplex section group No., a distance between the opposed WDM transmission equipments in the optical multiplex section or physical characteristics of optical fibers constructing the optical links as the attribute items of the optical links.

49. A communication network according to Claim 46, wherein the attributes of the optical links, which have been discovered by collecting the common portions of the attribute items of the optical link attribute tables administered by the optical link controllers, include an output optical switch equipment No., an output interface No., a wavelength, a signal rate, a signal format, an optical multiplex section group No., an input optical switch equipment No., a distance between the opposed WDM transmission equipments in the optical multiplex section or physical characteristics of optical fibers constructing the optical links as the attribute items.

50. A WDM transmission equipment for forming an optical multiplex section together with opposed devices and an arbitrary number of optical amplifiers between the opposed devices, comprising:

a uni-directional in-band control channel provided in the optical multiplex section between the input/output ports of the opposed devices and along all optical links through the optical multiplex section;

a control channel terminator for terminating the uni-directional in-band control channel; and

optical link controllers for administering the every optical links by exchanging control messages through the control channel terminators.

51. A WDM transmission equipment according to Claim 50, wherein:

the signal wave band of the data channel on the optical links and the signal wave band of the uni-directional in-band control channels are different, and

the ports include WDM couplers for demultiplexing/multiplexing the two different wave bands in all the optical links.

52. A WDM transmission equipment according to Claim 51, wherein in any of optical transmitters and optical receivers for transmitting control messages to the uni-directional in-band control channels, 1 x N (N: a positive integer) optical switches connected with either one optical transmitter or one optical receiver are switched at a predetermined time interval to time-division share either the optical transmitter or the optical receiver among the N uni-directional control channels.

53. A WDM transmission equipment according to Claim 50, wherein:

the signal wave band of the data channel on the optical links and the signal wave band of the uni-directional in-band control channels are identical,

the ports include 1 x 2 optical switches provided in all optical links, and

the optical links are employed as data channels during the data transmission and as control channels at other times by switching the 1 x 2 optical switches.

54. A WDM transmission equipment according to Claim 53, wherein in any of optical transmitters and optical receivers for transmitting control messages to the uni-directional in-band control channels, 1 x N (N: a positive integer) optical switches connected with either one optical transmitter or one optical receiver are switched at a predetermined time interval to time-division share either the optical transmitter or the optical receiver among the N uni-directional control channels.

55. A WDM transmission equipment according to Claim 50, wherein the optical link controllers:

administer individual optical link attribute tables for specifying the attribute items of the optical links and their attribute values for the every optical links;

discover the attributes of the optical links by storing the individual optical link attribute tables in the control messages and exchanging them mutually, by comparing the attribute values for the every attribute items of the individual optical link attribute tables, and by collecting the common portions of the attribute values;

set up the optical links, of which the discovery of the attributes has failed, in an initial state;

set up the optical links, of which the discovery of the attributes has succeeded, in an usable state; and

set up the optical links, of which no common portion of the attribute values has existed so that the discovery of the attributes has failed, as an error in an unusable state,

thereby to perform the state administrations for the every optical links.

56. A WDM transmission equipment according to Claim 55

wherein the optical link attribute tables to be administered by the optical link controllers include at least a wavelength, a signal rate, a signal format and an optical multiplex section group No., a distance between the opposed WDM transmission equipments in the optical multiplex section or physical

characteristics of optical fibers constructing the optical links as the attribute items of the optical links.

57. A WDM transmission equipment according to Claim 55, wherein the attributes of the optical links, which have been discovered by collecting the common portions of the attribute items of the optical link attribute tables administered by the optical link controllers, include an output optical switch equipment No., an output interface No., a wavelength, a signal rate, a signal format, an optical multiplex section group No., an input optical switch equipment No., a distance between the opposed WDM transmission equipments in the optical multiplex section or physical characteristics of optical fibers constructing the optical links as the attribute items.

58. A WDM transmission equipment for forming an optical multiplex section together with opposed devices for transmitting downstream and upstream signals, respectively, and an arbitrary number of optical amplifiers between the opposed devices, comprising:

a first uni-directional in-band control channel provided in the optical multiplex section between the input/output ports of the opposed devices and along all downstream optical links through the optical multiplex section;

a second uni-directional in-band control channel provided in the optical multiplex section between the input/output ports of the opposed devices and along all upstream optical links through the optical multiplex section and directed in the direction opposite to the control channels in the downstream optical links;

a control channel terminator for terminating the first and second uni-directional in-band control channel; and

optical link controllers for administering the every optical links by exchanging control messages through the control channel terminators.

59. A WDM transmission equipment according to Claim 58, wherein:

the signal wave band of the data channel on the optical links and the signal wave band of the uni-directional in-band control channels are different, and

the ports include WDM couplers for demultiplexing/multiplexing the two different wave bands in all the optical links.

60. A WDM transmission equipment according to Claim 59, wherein in any of optical transmitters and optical receivers for transmitting control messages to the uni-directional in-band control channels, 1 x N (N: a positive integer) optical switches connected with either one optical transmitter or one optical receiver are switched at a predetermined time interval to time-division share either the optical transmitter or the optical receiver among the N uni-directional control channels.

61. A WDM transmission equipment according to Claim 58, wherein:

the signal wave band of the data channel on the optical links and the signal wave band of the uni-directional in-band control channels are identical,

the ports include 1 x 2 optical switches provided in all optical links, and

the optical links are employed as data channels during the data transmission and as control channels at other times by switching the 1 x 2 optical switches.

62. A WDM transmission equipment according to Claim 59, wherein in any of optical transmitters and optical receivers for transmitting control messages to the uni-directional in-band control channels, 1 x N (N: a positive integer) optical switches connected with either one optical transmitter or one optical receiver are switched at a predetermined time interval to time-division share either the optical transmitter or the optical receiver among the N uni-directional control channels.

63. A WDM transmission equipment according to Claim 58, wherein the optical link controllers:

administer individual optical link attribute tables for specifying the attribute items of the optical links and their attribute values for the every optical links;

discover the attributes of the optical links by storing the individual optical link attribute tables in the control messages and exchanging them mutually, by

comparing the attribute values for the every attribute items of the individual optical link attribute tables, and by collecting the common portions of the attribute values;

set up the optical links, of which the discovery of the attributes has failed, in an initial state;

set up the optical links, of which the discovery of the attributes has succeeded, in an usable state; and

set up the optical links, of which no common portion of the attribute values has existed so that the discovery of the attributes has failed, as an error in an unusable state,

thereby to perform the state administrations for the every optical links.

64. A WDM transmission equipment according to Claim 63, wherein the optical link attribute tables to be administered by the optical link controllers include at least a wavelength, a signal rate, a signal format and an optical multiplex section group No., a distance between the opposed WDM transmission equipments in the optical multiplex section or physical characteristics of optical fibers constructing the optical links as the attribute items of the optical links.

65. A WDM transmission equipment according to Claim 63, wherein the attributes of the optical links, which have been discovered by collecting the common portions of the attribute items of the optical link attribute tables administered by the optical link controllers, include an output optical switch equipment No., an output interface No., a wavelength, a signal rate, a signal format, an optical multiplex section group No., an input optical switch equipment No., a distance between the opposed WDM transmission equipments in the optical multiplex section or physical characteristics of optical fibers constructing the optical links as the attribute items.

66. A WDM transmission equipment for forming an optical multiplex section together with opposed devices and an arbitrary number of optical amplifiers between the opposed devices, comprising:

a bi-directional in-band control channel provided in the optical multiplex section between the input/output ports of the opposed devices and along all optical links through the optical multiplex section;

a control channel terminator for terminating the bi-directional in-band control channel; and

optical link controllers for administering the every optical links by exchanging control messages through the control channel terminators.

67. A WDM transmission equipment according to Claim 66, wherein the optical link controllers:

administer individual optical link attribute tables for specifying the attribute items of the optical links and their attribute values for the every optical links;

discover the attributes of the optical links by storing the individual optical link attribute tables in the control messages and exchanging them mutually, by comparing the attribute values for the every attribute items of the individual optical link attribute tables, and by collecting the common portions of the attribute values;

set up the optical links, of which the discovery of the attributes has failed, in an initial state;

set up the optical links, of which the discovery of the attributes has succeeded, in an usable state; and

set up the optical links, of which no common portion of the attribute values has existed so that the discovery of the attributes has failed, as an error in an unusable state,

thereby to perform the state administrations for the every optical links.

68. A WDM transmission equipment according to Claim 67, wherein the optical link attribute tables to be administered by the optical link controllers include at least a wavelength, a signal rate, a signal format and an optical multiplex section group No., a distance between the opposed WDM transmission equipments in the optical multiplex section or physical characteristics of optical fibers constructing the optical links as the attribute items of the optical links.

69. A WDM transmission equipment according to Claim 67, wherein the attributes of the optical links, which have been discovered by collecting the common portions of the attribute items of the optical link attribute tables administered by the optical link controllers, include an output optical switch equipment No., an output interface No., a wavelength, a signal rate, a signal format, an optical multiplex section group No., an input optical switch equipment No., a distance between the opposed WDM transmission equipments in the optical multiplex section or physical characteristics of optical fibers constructing the optical links as the attribute items.

70. An optical link attribute/state administrating method for a communication network having a plurality of optical communication devices connected with each other, comprising:

defining an optical link section leading from the output interfaces of a first optical communication device of a transmission source to the input interfaces of an adjoining second optical communication device;

providing in-band control channels for every optical links between the first and second optical communication devices; and

exchanging the optical link attributes, as specified by the interfaces of the first and second optical communication devices, as control messages through the in-band control channels.

71. An optical link attribute/state administering method according to Claim 70, wherein at least one of the first and second optical communication devices is an optical switch equipment which is constructed to use a transparent optical switch.

72. An optical link attribute/state administering method according to Claim 70, further comprising:

providing uni-directional in-band control channels in every optical links leading from the output interfaces of one of the first and second optical communication devices to the input interfaces of the other of the first and second

optical communication devices, between the interfaces of the first and second optical communication devices along and for the every optical links;

providing an out-band control channel between the first and second optical communication devices;

terminating the uni-directional in-band control channels and the out-band control channel at control channel terminators; and

causing optical link controllers to administer the every optical links by exchanging control messages through the control channel terminators.

73. An optical link attribute/state administering method according to Claim 70 , further comprising:

providing a first uni-directional in-band control channel in every downstream optical links leading from the output interfaces of one of the first and second optical communication devices to the input interfaces of the other of the first and second optical communication devices, between the interfaces of the first and second optical communication devices and the ports of a WDM transmission equipment connected with the interfaces, along and for the every downstream optical links;

providing a second uni-directional in-band control channel in every upstream optical links leading from the output interfaces of the other of the first and second optical communication devices to the input interfaces of the one of the first and second optical communication devices, between the interfaces of the first and second optical communication devices along and for the every upstream optical links and directed in the direction opposite to the control channel in the downstream optical links;

terminating the first and second uni-directional in-band control channels at control channel terminators; and

causing optical link controllers to administer the every optical links by exchanging control messages through the control channel terminators.

74. An optical link attribute/state administering method according to Claim 70, further comprising:

providing a bi-directional in-band control channel in every optical links leading from the output interfaces of one of the first and second optical communication devices to the input interfaces of the other of the first and second optical communication devices, between the interfaces of the first and second optical communication devices along and for the every optical links;

terminating the bi-directional in-band control channels at a control channel terminator; and

causing optical link controllers to administer the every optical links by exchanging control messages through the control channel terminators.

75. An optical link attribute/state administering method according to Claim 70, wherein:

the signal wave band of the data channel on the optical links and the signal wave band of the uni-directional in-band control channels are different, and

the interfaces of the first and second optical communication devices demultiplex/multiplex the two different wave bands in all the optical links by WDM couplers.

76. An optical link attribute/state administering method according to Claim 75, wherein in any of optical transmitters and optical receivers for transmitting control messages to the uni-directional in-band control channels, 1 x N (N: a positive integer) optical switches connected with either one optical transmitter or one optical receiver are switched at a predetermined time interval to time-division share either the optical transmitter or the optical receiver among the N uni-directional control channels.

77. An optical link attribute/state administering method according to Claim 70, wherein:

the signal wave band of the data channel on the optical links and the signal wave band of the uni-directional in-band control channels are identical,

the optical links are employed as data channels during the data transmission and as control channels at other times as the interfaces of the first and second optical communication devices switch 1 x 2 optical switches provided in all optical links.

78. An optical link attribute/state administering method according to Claim 77, wherein in any of optical transmitters and optical receivers for transmitting control messages to the uni-directional in-band control channels, 1 x N (N: a positive integer) optical switches connected with either one optical transmitter or one optical receiver are switched at a predetermined time interval to time-division share either the optical transmitter or the optical receiver among the N uni-directional control channels.

79. An optical link attribute/state administering method according to Claim 70, wherein the optical link controllers:

administer individual optical link attribute tables for specifying the attribute items of the optical links and their attribute values individually for the every optical links;

discover the attributes of the optical links by storing the individual optical link attribute tables in the control messages and exchanging them mutually, by comparing the attribute values for the every attribute items of the individual optical link attribute tables, and by collecting the common portions of the attribute values;

set up the optical links, of which the discovery of the attributes has failed, in an initial state;

set up the optical links, of which the discovery of the attributes has succeeded, in an usable state; and

set up the optical links, of which no common portion of the attribute values has existed so that the discovery of the attributes has failed, as an error in an unusable state,

thereby to perform the state administrations for the every optical links.

80. A communication network according to Claim 79, wherein the optical link attribute tables to be administered by the optical link controllers include a device No., an interface No., a wavelength, a signal rate and a signal format or physical characteristics of optical fibers constructing the optical links as the attribute items of the optical links.

81. An optical link attribute/state administering method according to Claim 79, wherein the attributes of the optical links, which have been discovered by collecting the common portions of the attribute items of the optical link attribute tables administered by the optical link controllers, include an output device No., an output interface No., a wavelengt, a signal rate, a signal format, an input device No., an input interface No., or physical characteristics of optical fibers constructing the optical links as the attribute items.

82. An optical link attribute/state administrating method for a communication network having a plurality of optical communication devices connected with each other through a WDM transmission equipment, comprising:

defining an optical link section leading from the output interfaces of a first optical communication device of a transmission source to the input interfaces of an adjoining second optical communication device;

providing in-band control channels for every optical links along optical links between the first and second optical communication devices and an optical multiplex section; and

exchanging the optical link attributes, as specified by the interfaces of the first and second optical communication devices, and the optical link attributes, as specified by the optical multiplex section, as control messages through the in-band control channels.

83. An optical link attribute/state administering method according to Claim 82, wherein the first and second optical communication devices adjoin and are connected with each other through the optical multiplex section, and at least

one of the same is an optical switch equipment which is constructed to use a transparent optical switch equipment.

84. An optical link attribute/state administering method according to Claim 82, wherein the optical multiplex section includes: at least one set of opposed WDM transmission equipments; and an arbitrary number of optical amplifiers between the opposed WDM transmission equipments.

85. An optical link attribute/state administering method according to Claim 84, further comprising:

providing a first uni-directional in-band control channel in every optical links leading from the output interfaces of the one optical communication device of the first and second optical communication devices through the optical multiplex section to the input interfaces of the other optical communication device of the first and second optical communication devices, between the interfaces of the first and second optical communication devices and the ports of the WDM transmission equipment connected with the interfaces, along and for the every optical links;

providing a second uni-directional in-band control channel in the optical multiplex section between the output ports of one of the WDM transmission equipments and the input ports of the other, along the optical links;

providing an out-band control channel between the first and second optical communication devices;

terminating the first uni-directional in-band control channel and the out-band control channel at the control channel terminators in the first and second optical communication devices;

causing optical link controllers to administer the every optical links by exchanging control messages through the control channel terminators;

terminating the first and second uni-directional in-band control channels at the control channel terminators in the opposed WDM transmission equipments; and

causing optical link controllers to administer the every optical links by exchanging control messages through the control channel terminators.

86. An optical link attribute/state administering method according to Claim 84, further comprising:

providing a first bi-directional in-band control channel in every optical links leading from the output interfaces of the one optical communication device of the first and second optical communication devices through the optical multiplex section to the input interfaces of the other optical communication device of the first and second optical communication devices, between the interfaces of the first and second optical communication devices and the ports of the WDM transmission equipment connected with the interfaces, along and for the every optical links;

providing a second bi-directional in-band control channel in the optical multiplex section between the output ports and the input ports of the opposed WDM transmission equipments, along the optical links;

terminating the first bi-directional in-band control channel at the control channel terminators in the first and second optical communication devices;

causing optical link controllers to administer the every optical links by exchanging control messages through the control channel terminators;

terminating the first and second bi-directional in-band control channels at the control channel terminators in the opposed WDM transmission equipments; and

causing optical link controllers to administer the every optical links by exchanging control messages through the control channel terminators.

87. An optical link attribute/state administering method according to Claim 86, wherein the optical multiplex section includes: at least one set of opposed WDM transmission equipments for transmitting downstream and upstream signals, respectively; and an arbitrary number of optical amplifiers between the opposed WDM transmission equipments.

88. An optical link attribute/state administering method according to Claim 87, further comprising:

providing a first uni-directional in-band control channel in every downstream optical links leading from the output interfaces of the one optical communication device of the first and second optical communication devices through the optical multiplex section to the input interfaces of the other optical communication device of the first and second optical communication devices, between the interfaces of the first and second optical communication devices and the ports of the WDM transmission equipment connected with the interfaces, along and for the every downstream optical links;

providing a second uni-directional in-band control channel in the optical multiplex section between the output ports of one of the opposed WDM transmission equipments for transmitting the downstream signals and the input ports of the other, along the downstream optical links;

providing a third uni-directional in-band control channel in every upstream optical links leading from the output interfaces of the other optical communication device of the first and second optical communication devices through the optical multiplex section to the input interfaces of the one optical communication device of the first and second optical communication devices, between the interfaces of the first and second optical communication devices and the ports of the WDM transmission equipment connected with the interfaces, along and for the every upstream optical links and directed in the direction opposite to the control channels in the downstream optical links;

providing a fourth uni-directional in-band control channel in the optical multiplex section between the output ports of one of the opposed WDM transmission equipments for transmitting the upstream signals and the input ports of the other, along the upstream optical links and directed in the direction opposite to the control channels in the downstream optical links;

terminating the first and third uni-directional in-band control channels at the control channel terminators in the first and second optical communication devices;

causing optical link controllers to administer the every optical links by exchanging control messages through the control channel terminators;

terminating the first and second uni-directional in-band control channels at the control channel terminators in the opposed WDM transmission equipments for transmitting the downstream signals;

causing optical link controllers to administer the every optical links by exchanging control messages through the control channel terminators;

terminating the third and fourth uni-directional in-band control channels at the control channel terminators in the opposed WDM transmission equipments for transmitting the upstream signals;

causing optical link controllers to administer the every optical links by exchanging control messages through the control channel terminators.

89. An optical link attribute/state administering method according to Claim 82,

wherein the signal wave band of the data channel on the optical links and the signal wave band of the uni-directional in-band control channels are different, and

wherein the interfaces of the first and second optical communication devices and the ports of the opposed WDM transmission equipments demultiplex/multiplex the two different wave bands in all the optical links by WDM couplers.

90. An optical link attribute/state administering method according to Claim 89, wherein in any of optical transmitters and optical receivers for transmitting control messages to the uni-directional in-band control channels, 1 x N (N: a positive integer) optical switches connected with either one optical transmitter or one optical receiver are switched at a predetermined time interval to

time-division share either the optical transmitter or the optical receiver among the N uni-directional control channels.

91. An optical link attribute/state administering method according to Claim 82, wherein:

the signal wave band of the data channel on the optical links and the signal wave band of the uni-directional in-band control channels are identical,

the optical links are employed as data channels during the data transmission and as control channels at other times as the interfaces of the first and second optical communication devices and the ports of the opposed WDM transmission equipments switch 1 x 2 optical switches provided in all optical links.

92. An optical link attribute/state administering method according to Claim 91, wherein in any of optical transmitters and optical receivers for transmitting control messages to the uni-directional in-band control channels, 1 x N (N: a positive integer) optical switches connected with either one optical transmitter or one optical receiver are switched at a predetermined time interval to time-division share either the optical transmitter or the optical receiver among the N uni-directional control channels.

93. An optical link attribute/state administering method according to Claim 82,

wherein the optical link controllers of the first and second optical communication devices and the opposed WDM transmission equipments:

administer individual optical link attribute tables for specifying the attribute items of the optical links and their attribute values individually for the every optical links;

discover the attributes of the optical links by storing the individual optical link attribute tables in the control messages and exchanging them mutually, by comparing the attribute values for the every attribute items of the individual optical link attribute tables, and by collecting the common portions of the attribute values;

set up the optical links, of which the discovery of the attributes has failed, in an initial state;

set up the optical links, of which the discovery of the attributes has succeeded, in an usable state; and

set up the optical links, of which no common portion of the attribute values has existed so that the discovery of the attributes has failed, as an error in an unusable state,

thereby to perform the state administrations for the every optical links.

94. An optical link attribute/state administering method according to Claim 93, wherein the optical link attribute tables to be administered by the optical link controllers on the first and second optical communication devices include at least an optical switch equipment No., an interface No., a wavelength, a signal rate, a signal format, a distance between the opposed WDM transmission equipments in the optical multiplex section or physical characteristics of optical fibers constructing the optical links as the attribute items of the optical links.

95. An optical link attribute/state administering method according to Claim 93, wherein:

the optical link attribute tables to be administered by the optical link controllers on the WDM transmission equipment include at least a wavelength, a signal rate, a signal format and an optical multiplex section group No., a distance between the opposed WDM transmission equipments in the optical multiplex section or physical characteristics of optical fibers constructing the optical links as the attribute items of the optical links.

96. An optical link attribute/state administering method according to Claim 93, wherein the attributes of the optical links, which have been discovered by collecting the common portions of the attribute items of the optical link attribute tables administered by the optical link controllers, include an output optical switch equipment No., an output interface No., a wavelength, a signal rate, a signal format, an optical multiplex section group No., an input optical switch equipment

No., a distance between the opposed WDM transmission equipments in the optical multiplex section or physical characteristics of optical fibers constructing the optical links as the attribute items.

97. An optical switch equipment wherein the common portion of attribute informations owned by individual devices in an optical link, to which an own device belongs, is the attribute information of the optical link.

98. An optical switch equipment according to Claim 97, wherein the optical link is treated as an error in the absence of the common portion.

99. An optical switch equipment according to Claim 97, wherein at least one of the first and second optical communication devices is an optical switch equipment which is constructed to use a transparent optical switch.

100. An optical switch equipment connected with adjoining optical communication device, comprising:

uni-directional in-band control channels provided in every optical links leading from output interfaces to the input interfaces of the adjoining optical communication devices, between the interfaces of the adjoining optical communication devices for the every optical links;

an out-band control channel provided between the adjoining optical communication devices;

control channel terminators for terminating a uni-directional in-band control channel and an out-band control channel; and

optical link controllers for administering the every optical links by exchanging control messages through the control channel terminators.

101. An optical switch equipment according to Claim 100, wherein at least one of the first and second optical communication devices is an optical switch equipment which is constructed to use a transparent optical switch.

102. An optical switch equipment according to Claim 100, wherein:

the signal wave band of the data channel on the optical links and the signal wave band of the uni-directional in-band control channels are different, and

the interfaces of the adjoining optical communication devices demultiplex/multiplex the two difference wave bands in all the optical links by WDM couplers.

103. An optical switch equipment according to Claim 102, wherein in any of optical transmitters and optical receivers for transmitting control messages to the uni-directional in-band control channels, 1 x N (N: a positive integer) optical switches connected with either one optical transmitter or one optical receiver are switched at a predetermined time interval to time-division share either the optical transmitter or the optical receiver among the N uni-directional control channels.

104. An optical switch equipment according to Claim 100, wherein the signal wave band of the data channel on the optical links and the signal wave band of the uni-directional in-band control channels are identical,

wherein the interfaces of the adjoining optical communication devices include 1 x 2 optical switches provided in all optical links, and

wherein the optical links are employed as data channels during the data transmission and as control channels at other times by switching the 1 x 2 optical switches.

105. An optical switch equipment according to Claim 104, wherein in any of optical transmitters and optical receivers for transmitting control messages to the uni-directional in-band control channels, 1 x N (N: a positive integer) optical switches connected with either one optical transmitter or one optical receiver are switched at a predetermined time interval to time-division share either the optical transmitter or the optical receiver among the N uni-directional control channels.

106. An optical switch equipment according to Claim 104, wherein the optical link controllers:

administer optical link attribute tables for specifying the attribute items of the optical links and their attribute values for the every optical links;

exchange the optical link attribute tables with one of the adjoining optical communication devices and the adjoining optical switch equipments;

compare the attribute values for the every attribute items of the optical link attribute tables;

discover the attributes of the optical links by collecting the common portions of the attribute values;

set up the optical links, of which no common portion of the attribute values has existed so that the discovery of the attributes has failed, as an error in an unusable state,

thereby to perform the state administrations for the every optical links.

107. An optical switch equipment according to Claim 106, wherein the optical link attribute tables to be administered by the optical link controllers include a device No., an interface No., a wavelength, a signal rate and a signal format or physical characteristics of optical fibers constructing the optical links as the attribute items of the optical links.

108. An optical switch equipment according to Claim 106, wherein the attributes of the optical links, which have been discovered by collecting the common portions of the attribute items of the optical link attribute tables administered by the optical link controllers, include an output device No., an output interface No., a wavelength, a signal rate, a signal format, an input device No., an input interface No., or physical characteristics of optical fibers constructing the optical links as the attribute items.

109. An optical switch equipment connected with adjoining optical communication device, comprising:

a first uni-directional in-band control channel provided in every downstream optical links leading from output interfaces to the input interfaces of the adjoining optical communication devices, between the interfaces of the adjoining optical communication devices for the every downstream optical links;

a second uni-directional in-band control channel provided in every upstream optical links leading from the output interfaces of the adjoining optical communication devices to the input interfaces of the own device, between the

interfaces of the adjoining optical communication devices for the every upstream optical links and directed in the direction opposite to the control channel in the downstream optical links;

control channel terminators for terminating the first and second uni-directional in-band control channels; and

optical link controllers for administering the every optical links by exchanging control messages through the control channel terminators.

110. An optical switch equipment according to Claim 109, wherein:

the signal wave band of the data channel on the optical links and the signal wave band of the uni-directional in-band control channels are different, and

the interfaces of the adjoining optical communication devices demultiplex/multiplex the two difference wave bands in all the optical links by WDM couplers.

111. An optical switch equipment according to Claim 110, wherein in any of optical transmitters and optical receivers for transmitting control messages to the uni-directional in-band control channels, 1 x N (N: a positive integer) optical switches connected with either one optical transmitter or one optical receiver are switched at a predetermined time interval to time-division share either the optical transmitter or the optical receiver among the N uni-directional control channels.

112. An optical switch equipment according to Claim 109, wherein at least one of the first and second optical communication devices is an optical switch equipment which is constructed to use a transparent optical switch.

113. An optical switch equipment according to Claim 109, wherein:

the signal wave band of the data channel on the optical links and the signal wave band of the uni-directional in-band control channels are identical,

the interfaces of the adjoining optical communication devices include 1 x 2 optical switches provided in all optical links, and

the optical links are employed as data channels during the data transmission and as control channels at other times by switching the 1 x 2 optical switches.

114. An optical switch equipment according to Claim 113, wherein in any of optical transmitters and optical receivers for transmitting control messages to the uni-directional in-band control channels, 1 x N (N: a positive integer) optical switches connected with either one optical transmitter or one optical receiver are switched at a predetermined time interval to time-division share either the optical transmitter or the optical receiver among the N uni-directional control channels.

115. An optical switch equipment according to Claim 109, wherein the optical link controllers:

administer optical link attribute tables for specifying the attribute items of the optical links and their attribute values for the every optical links;

exchange the optical link attribute tables with one of the adjoining optical communication devices and the adjoining optical switch equipments;

compare the attribute values for the every attribute items of the optical link attribute tables;

discover the attributes of the optical links by collecting the common portions of the attribute values;

set up the optical links, of which no common portion of the attribute values has existed so that the discovery of the attributes has failed, as an error in an unusable state,

thereby to perform the state administrations for the every optical links.

116. An optical switch equipment according to Claim 115, wherein the optical link attribute tables to be administered by the optical link controllers include a device No., an interface No., a wavelength, a signal rate and a signal format or physical characteristics of optical fibers constructing the optical links as the attribute items of the optical links.

117. An optical switch equipment according to Claim 115, wherein the attributes of the optical links, which have been discovered by collecting the common portions of the attribute items of the optical link attribute tables administered by the optical link controllers, include an output device No., an output interface No., a wavelength, a signal rate, a signal format, an input device No., an input interface No., or physical characteristics of optical fibers constructing the optical links as the attribute items.

118. An optical switch equipment connected with adjoining optical communication device, comprising:

a bi-directional in-band control channel provided in every optical links leading from output interfaces to the input interfaces of the adjoining optical communication devices, between the interfaces of the adjoining optical communication devices for the every optical links;

a control channel terminator for terminating a bi-directional in-band control channel; and

optical link controllers for administering the every optical links by exchanging control messages through the control channel terminators.

119. An optical switch equipment according to Claim 118, wherein at least one of the first and second optical communication devices is an optical switch equipment which is constructed to use a transparent optical switch.

120. An optical switch equipment according to Claim 118, wherein the optical link controllers:

administer optical link attribute tables for specifying the attribute items of the optical links and their attribute values for the every optical links;

exchange the optical link attribute tables with one of the adjoining optical communication devices and the adjoining optical switch equipments;

compare the attribute values for the every attribute items of the optical link attribute tables;

discover the attributes of the optical links by collecting the common portions of the attribute values;

set up the optical links, of which no common portion of the attribute values has existed so that the discovery of the attributes has failed, as an error in an unusable state,

thereby to perform the state administrations for the every optical links.

121. An optical switch equipment according to Claim 120, wherein the optical link attribute tables to be administered by the optical link controllers include a device No., an interface No., a wavelength, a signal rate and a signal format or physical characteristics of optical fibers constructing the optical links as the attribute items of the optical links.

122. An optical switch equipment according to Claim 120, wherein the attributes of the optical links, which have been discovered by collecting the common portions of the attribute items of the optical link attribute tables administered by the optical link controllers, include an output device No., an output interface No., a wavelength, a signal rate, a signal format, an input device No., an input interface No., or physical characteristics of optical fibers constructing the optical links as the attribute items.